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# TWIN OIL-WELL DRILLING IN THE USSR

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Moscow, May 1954

Some 300,000 meters have been drilled and 170 wells finished by the twin-well method since it was first initiated in 1950. The method has been mainly employed in the Azneft', Dagneft', and Kuybyshevneft' associations. In the latter association, the volume of twin-well drilling has been increasing considerably each year.

Initiated in 1950 with the use of a centering apparatus, the method was discontinued in Azneft' after the rigs began to break down, but was resumed in 1952 with new equipment (special rig, rotors, and transferable crown block, the latter replacing the centering device). The volume of such drilling in Azneft' has increased considerably in 1953, and the indexes for all completed wells have been satisfactory. However, the volume in Dagneft' has been declining lately.

The principal advantages of twin-well drilling over single-well, or single-bore, are that two holes are bored at the same time, drilling time is reduced, and less equipment is needed.

In twin-well drilling, the running-in and lifting operations are performed simultaneously, the lifting of tools from one hole being tied in with the running-in of tools into the other hole. The preparatory and ancillary work for one bore is almost completely tied in with other work for the second bore. Waiting for the cement to harden in one bore is tied in with other work in the second bore. The rig erecting and assembly work is reduced considerably, and the work involved in moving the rig is cut in half. The investment of capital and the use of metal in twin-well drilling are reduced considerably.

In late March 1953, the economic section of the Technical Council of the Ministry of Petroleum Industry USSR considered the effectiveness of twin-well drilling and, based upon its study of the method in the Kuybyshevneft' and Dagneft' associations up to September 1952, decided that twin-well drilling would thereafter replace single-shaft directional drilling. In addition, the economic section found that, by employing twin-well instead of vertical drilling in settled contour conditions, it would be possible to increase the technical and economic indexes for commercial speeds of drilling 10-15 percent and that well construction costs could be cut by 6-8 percent.

The estimates which have been proven for conditions in Tatneft' Association show that if the speed of drilling is stepped up 15 percent in the first 2 years after twin-well drilling is initiated, and then increased in subsequent years to 20 percent, as compared with single well drilling, the well-month exploitation should increase between 14 and 18 percent, inasmuch as 25 percent more wells would be finished with one machine. (See Table 1, below.)

Considering the balance of time involved during 1 1/2 years in drilling exploitational, single-bore directional wells, the conversion to twin-well drilling with a single unit of drilling equipment has made possible the attainment of a considerable increase in commercial and continuous [tsiklovykh] speeds of the depth driven.

Table 2 (below) provides information on the experience of twin-well drilling in Stavropol'neft' Trust of Azneft' Association. In this region it was theoretically possible to calculate the average saving of time shown in the table for a 1,300-meter operating well driven through rock-bearing strata.

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The actual technical and economic indexes obtained in twin-well drilling in Stavropol'neft' Trust and other rayons indicate some definite achievement. However, it must be concluded that the existing potential of twin-well drilling is not being used satisfactorily. There are enormous reserves in twin-well drilling which, if realized, could considerably increase the commercial and continuous [mechanical?] drilling speeds and thereby cut well construction costs.

Table 3 compares the actual and potential technical-economic indexes (under comparable conditions) for wells drilled in Stavropol'neft' Trust under the existing organization and technological conditions for drilling directional wells.

When the commercial speeds of the better-drilled wells in Stavropol'neft' Trust (under comparable conditions) are compared, the actual speed ratio weighs heavily in favor of twin-well drilling. This can be seen in Table 4.

To show the further effect of twin-well drilling, the principal indexes of the single-bore and twin-bore methods are compared on the basis of 3 years' experience in Dagestan. This can be seen in Tables 5 and 6. The comparison was made for commercial and mechanical speeds and for the time balance in drilling.

The wells drilled are divided into three groups, depending on the depth. The "A" group includes wells 890-950 meters deep; the "B" group, wells 1,100-1,250 meters deep; and the "C" group, wells 1,500 and more meters deep.

Neither exploitational, single-bore, double-column structure [dvykhkolonykh konstruktsiy] wells, nor exploratory wells are included in the comparison, inasmuch as the speed of drilling is low in both cases. Nor does the comparison include wells which have been rebored and involve a large percentage of unproductivity, or those wells which are not at least as deep as other single-bore wells.

Table 5 shows that the commercial and mechanical speeds are higher in the case of twin wells than in single-bore wells, but the drive for depth is somewhat less.

All the wells have been drilled under the same conditions. The pressure on the bit varied between 5 and 7 tons in the upper part and between 8 and 10 tons in the lower part. The pumps operated at 32-36 liters per second. In the case of some wells, both single and twin, the pressure on the bit was increased to 12-15 tons, while the water feed was increased to 40-42 liters per second. The mud solution was the same for all wells drilled, inasmuch as they were drilled under the same geological conditions. The specific weight of the mud solution varied between 1.25 and 1.32 grams per cubic centimeter. Viscosity varied between 40 and 50 seconds, while the amount of sand in the solution varied between zero and 2 percent.

As can be seen from Table 6, it takes less time to drill one meter of twin well than one meter of single-bore well. For instance, 1.56 hours are required to drill one meter of single-bore well of the B group, as compared with 1.15 hours in the case of a twin well. To drill one meter of the C group, an average of 2.02 hours are required for single bore wells as compared to 1.74 hours for twin wells.

The productive time per meter drilled varies in the case of both single and twin wells, depending on the depth. For instance, if no emergencies, idleness, or repairs are involved, one meter of twin well in the B group can be drilled in .86 hour, compared with 1.09 hours required for the same distance of single-bore well. In the C group, one meter of twin well can be drilled in 1.3 hours, whereas the same distance of single bore well required 1.39 hours.

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The technological process of running-in and pulling the tools is different in twin-well drilling from that of single-bore drilling. In the latter, the string of pipe must be pulled to replace the bit or turbo-drill pipe, whereas in twin-well drilling the pipe is pulled in one bore at the same time it is lowered into the adjacent bore.

In analyzing the unproductive time, the instruction of the Ministry of Petroleum Industry USSR relating to idleness has been taken into consideration. This time includes all idle periods, such as repair time, complications, and elimination of emergencies. The loss of time is considerably higher in single-bore than in twin-well drilling. It has been found from the experience of drillers in Dagestan that, under normal twin-well drilling operations, wells up to 1,700-1,800 meters deep can be drilled without any additional repair work being required. It follows, from the technological process of twin-well drilling itself, that the idle time charged to the well declines when compared to single-bore drilling.

In Izberbash, for instance, the idleness averaged .16 hour per driven meter in twin-wells of the B group (1,100-1,250 meters deep). In the case of single-bore wells of this group, the idleness has risen to .18 hour for the same depth. In the C group (1,500 or more meters deep), the idleness per meter amounted to .19 hour in twin wells and .29 hour in single-bore wells.

There is also a difference in time required to eliminate emergencies in the two types of wells. An average .17 hour is required per driven meter of single-bore wells of the B group. This time compares with .128 (less than 13/100) hour for the same distance in the case of twin-wells. In the C group, .233 (over 23/100) hour is required in single-bore wells, as compared with .15 hour in twin wells. These comparisons can be seen in Table 6.

Table 1. Well-Months of Exploitation During Drilling of Twin and Single Wells (Average per Machine)

| | 1st year | 2nd year | 3rd year | 4th year |
|---|---|---|---|---|
| Number of wells turned over | | | | |
| Single-Bore | 3 | 4 | 4 | 5 |
| Twin | 4 | 4 | 6 | 6 |
| Well-days of exploitation, including wells converted | | | | |
| Single-bore | 495 | 1,848 | 3,324 | 4,960 |
| Twin | 464 | 2,120 | 3,834 | 5,862 |
| Increase in well-months of exploitation in estimating for one machine per year of drilling | 1.0 | 9 | 17 | 18 |
| Speed of drilling | | | | |
| Single-bore | 600 | 660 | 726 | 798 |
| Twin | 690 | 760 | 870 | 958 |
| Percent increase | 15 | 15 | 20 | 20 |

Table 2. Twin-Well Drilling in Stavropol'neft' Trust

| Type of Work Involved | Time Balance for Single-Bore Drilling | | Possible Time In Twin-Well Drilling | |
|---|---|---|---|---|
| | Hours | Percent | Hours | Percent |
| Productive time | 1,650 | 66.0 | 1,800 | 65.4 |
| Mechanical drilling | 500 | 20.0 | 1,000 | 36.4 |
| Running-in, pulling | 375 | 15.0 | 375 | 13.6 |
| Jo[illegible]ing tools | 50 | 2.0 | 100 | 3.6 |
| Cle[illegible]thening well | 125 | 5.0 | 125 | 4.6 |
| Cement hardening | 75 | 3.0 | 75 | 2.8 |
| Readying, other [illegible]ental work | 600 | 24.0 | 200 | 7.2 |
| Unproductive time | 850 | 34.0 | 950 | 34.6 |
| Repairs | 175 | 7.0 | 175 | 6.4 |
| Eliminate emergencies, etc. | 300 | 12.0 | 400 | 14.5 |
| Idleness due to organization | 375 | 15.0 | 375 | 13.7 |
| Totals | 2,500 | 100.0 | 2,750 | 100.0 |

Table 3. Actual and Potential Technical-Economic Indexes in Stavropol'neft' Trust in Devonian and Rock-Bearing Formations

A. Devonian Formation (Average depth 1,800 meters)

| | Actual Average Index | | Potential Average Index |
|---|---|---|---|
| | Single Bore | Twin Well | Twin Well |
| Commercial drilling speed, in meters per machine month | 315 | 340 | 580 |
| Technological idleness, percent of drilling time | -- | 70-80 | about 35 |
| Changes in well costs (coefficient) | 1.0 | .86 | .75 |

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B. Rock-Bearing Formation (Average depth 1,300 meters)

| | Actual Average Index | | | Potential Average Index |
|---|---|---|---|---|
| | Single Bore, Directional | Single Vertical | Twin Well | Twin Well |
| Commercial drilling speed, in meters per machine month | 375 | 490 | 590 | 680 |
| Technological idleness, percent of drilling time | -- | -- | 70-80 | about 35 |
| Change in well costs (coefficient) | ..0 | .89 | .80 | .70 |

Table 4. Commercial Speeds for a Group of Wells in Stavropol'neft' Trust (Meters per Machine-Month)

| | Single Bore | | Twin Wells |
|---|---|---|---|
| | Directional | Vertical | |
| Devonian formation | 330-350 | 420-450 | 470-600 |
| Rock-bearing formation | 380-400 | 540-700 | 770-900 |

Table 5. Commercial and Mechanical Speeds in Dagestan

| Type | Group | Wells | Average Depth of Group (m) | Commercial Speed (m/mach-mo) | Mechanical Speed (m/hr) | Bits Used per Well Rod | Meters Drilled per Bit |
|---|---|---|---|---|---|---|---|
| Single-Bore | | | | | | | |
| | A | 1 | 890 | 926.0 | 8.09 | 19.0 | 46.8 |
| | B | 8 | 1,160 | 500.4 | 3.21 | 32.5 | 35.7 |
| | C | 4 | 1,712 | 370.8 | 2.87 | 85.7 | 20.0 |
| Twin | | | | | | | |
| | A | 5 | 915 | 977.0 | 9.19 | 24.2 | 37.8 |
| | B | 10 | 1,175 | 688.0 | 4.26 | 34.4 | 34.1 |
| | C | 5 | 1,686 | 403.0 | 3.56 | 91.6 | 18.4 |

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Table 6. Time Balance (in Hours) per Meter Drilled
(Based on 33 Wells in Izberbash)

| | Single Bore | Twin Wells |
|---|---|---|
| **Group A** (890-950 meters deep) | | |
| Meters drilled per hour, including: | .78 | .85 |
| Productive time | .69 | .66 |
| Mechanical drilling | .128 | .120 |
| Running-in, pulling | .122 | .120 |
| Unproductive time | .086 | .190 |
| Repairs | .030 | .027 |
| Idleness | .032 | .112 |
| Emergencies | .024 | .051 |
| **Group B** (1,100-1,250 meters deep) | | |
| Meters drilled per hour, including: | 1.56 | 1.15 |
| Productive time | 1.09 | .86 |
| Mechanical drilling | .326 | .25 |
| Running-in, pulling | .246 | .19 |
| Unproductive time | .470 | .30 |
| Repairs | .120 | .07 |
| Idleness | .180 | .165 |
| Emergencies | .170 | .128 |
| **Group C** (1,500 and more meters deep) | | |
| Meters drilled per hour, including: | 2.02 | 1.74 |
| Productive time | 1.39 | 1.30 |
| Mechanical drilling | .363 | .290 |
| Running-in, pulling | .27 | .33 |
| Unproductive time | .63 | .44 |
| Repairs | .105 | .100 |
| Idleness | .292 | .190 |
| Emergencies | .233 | .150 |

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